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Habitat associations and abundance of the Palawan Peacock-pheasant *Polyplectron emphanum*

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ABSTRACT

The Palawan Peacock-pheasant *Polyplectron emphanum* is a little-known and 'Vulnerable' species endemic to Palawan, Philippines. Survey data were collected using point count and line transect 'distance' methods in forest over three different soil types. Over 400 point counts and 78 km of transect produced just 36 encounters, all but five with calling males. Density estimates were extremely low at all sites (0.2-1.2 individuals/km^2) and some of the problems associated with distance sampling of tropical pheasant populations are discussed. A priority for future research is seen as the development of a cue-counting distance technique for this and other tropical Galliformes. Habitat structure was measured at the point count stations and at 42 display scrapes. There were no consistent differences between census stations at which the pheasant was recorded and 'negative' stations. While this may be to some extent due to the recording methods, a possibility is that, while the pheasant is never found away from forested areas, the species is found in a wide range of forests on the island. In contrast, male display areas were associated with areas containing high numbers of large trees, low numbers of fallen trees, and sparse ground and shrub level vegetation. These sites

tended to be within patches of undisturbed or little disturbed forest and availability of such microhabitats may be important in influencing local breeding densities. During further research on the Palawan Peacock-pheasant over the next two years we will map its distribution and abundance in different regions of the island and attempt to explain differences in local abundance in terms of both natural habitat variation and anthropogenic habitat change.

INTRODUCTION

The island of Palawan is located in the southwest of the Philippines archipelago (8°30'-12°45' N, 117°30'-121°45' E), flanked by the Sulu Sea to the south and South China Sea to the north and west (Figure 1). It covers 12,590 km^2 of largely hilly or mountainous upland with higher elevations in the central and southern ranges peaking at 2,085 m (Mount Mantalingajan). Apart from two main alluvial plains situated in the southeast of the island, there is little level or gently sloping land.

The Philippines Department of Environment and Natural Resources (DENR) categorises 5,339 km^2 (42.4% total land area) of the island as high biodiversity quality, and includes 4,039 km^2 (32.1%) of dipterocarp forest (DENR/UNEP 1997). Based on its vertebrate faunal richness and number of endemics, Palawan is identified as a high conservation priority within the Philippines (Hauge *et al.* 1986), while the uniqueness of its avifauna is recognised in Palawan's classification as an Endemic Bird Area (EBA), priority 'Urgent' (Stattersfield *et al.* 1998). Despite recognition of the island's high conservation priority (Stattersfield *et al.* 1998), only 258 km^2 or 3.5% of the island's forest is legally protected (Hauge *et al.* 1986, Collins *et al.* 1991). The projected loss of 4,400 km^2 (56.4%) of upland forests and catchments that accompanies the estimated population increase of 318,000 in 1983 to 980,000 in 2007 (DENR/UNEP 1997) highlights the urgent requirement of ecological data for effective land management policy.

The Palawan Peacock-pheasant *Polyplectron emphanum* is a 'Vulnerable' (Collar *et al.* 1994, McGowan & Garson 1995) species endemic to the island of Palawan. It inhabits lowland and hill primary and secondary forest to 800 m a.s.l. on flat to undulating terrain (McGowan *et al.* 1989, Caleda 1991), although there are records of the pheasant in forest above 1,200m a.s.l. (Dickinson *et al* 1991, Girdler 1996). The main threat to the pheasant is continuing and accelerating forest alteration, which, as a result of widespread clearance of lowland habitat (Quinnell & Balmford 1988, Lambert 1993), is increasingly restricting the pheasant to hill forest (McGowan *et al.* 1989). Recent work has attempted to investigate the ability of the species to tolerate such habitat alteration (Davison 1987). Population density estimates from various forest habitats (Caleda *et al.* 1987, Caleda 1991) suggest differences between forest type, with logged-over forest containing lower population densities than primary forest and forest edge. Like the Malaysian peacock pheasant *P. malacense*, male Palawan Peacock-pheasant maintain display areas, or scrape sites (Whitehead 1890) from where they call and posturally display to females. Work on the habitat requirements of the pheasant has indicated that male display grounds are positioned in areas significantly fewer large-girthed trees (McGowan *et al.* 1989).

The objectives of our project were to:

- Examine the distribution and abundance of the Palawan Peacock-pheasant in forest over different soil types,
- Characterise forest habitats utilised by the Palawan Peacock-pheasant, and
- Investigate the influence habitat has on the distribution of the display scrapes of calling males.

STUDY AREA and METHODS

Surveys were conducted at three clusters of five study sites (Figure 1) in forest over three soil types (Table 1) between October 1999 and February 2000 by David Lee (DL) and Mark Whiffin (MW). At each study site two survey methods, conducted concurrently within the same survey period, were used to survey the pheasant: a point count sampling method (variable circular plot method) (Buckland *et al*. 1993, Jones *et al*. 1995) and a variable-width line transect method (Buckland *et al*. 1993). Count stations were positioned 200 m apart along straight line transects and surveyed from 06h30-12h00, the morning peak period of pheasant activity (Johnsgard 1986). At each station an initial count period of 10 minutes was used to record all bird species. A further 10 minute period was sampled exclusively for the pheasant to increase expected low encounter rates of the species (e.g. McGowan *et al*. 1989). After each 20-minute count period, the 200 m to the next station was walked at 1km/h with the observer collecting perpendicular distance data on any flushed individuals or calling males. Stations and transects were repeated using the alternate observer in an attempt to reduce the effects of inter-observer variability (Bibby *et al*. 1992). The survey methods followed the normal assumptions of distance sampling (Buckland *et al*. 1993, Marsden 1999).

Figure 1: Study site locations and distribution of the Palawan Peacock-pheasant.

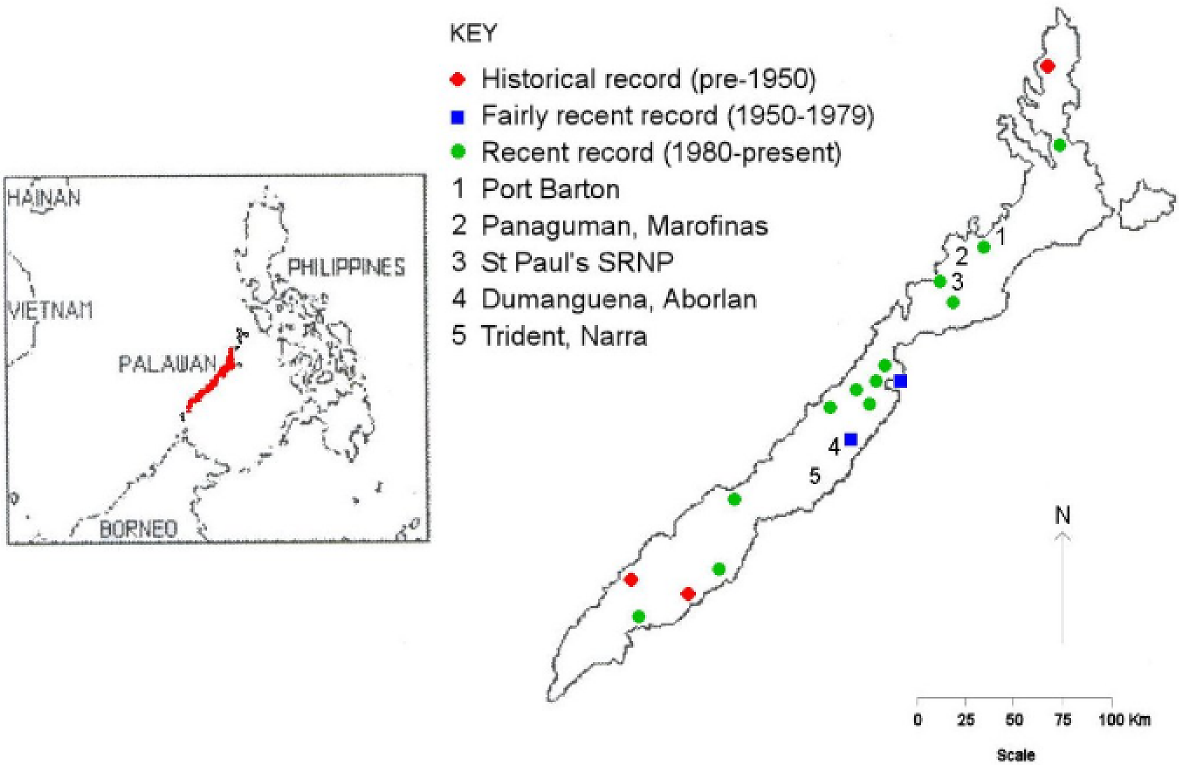

Table 1: Description of the five study sites surveyed. For all subsequent analyses, Port Barton and Panaguman (< 50 km apart), and Narra and Dumanguena (<50 km apart) are combined and analysis done by soil type. (SPSRNP = St. Paul's Subterranean River National Park). [1] - Since the 1960s (Caleda 1986).

Study site	Fix	Soil type	Altitude (m)	Human disturbance
SPSRNP	N 10°11.958' E 118°54.731'	Limestone	10 - 240	None
Panaguman, Marofinas	N 10°13.376' E 118°57.140'	Shale and sandstone	100 - 340	Hunting - attendant trails and shelters
Port Barton	N 10°24.654' E 118°11.220'	Shale and sandstone	70 - 300	Some areas selectively logged up to 1989; pig trapping in adjacent forest
Trident, Narra	N 09°19.430' E 118°21.757'	Ultrabasic	180 - 650	Collection of almaciga resin (*Agathis dammara*), attendant trails; possibly hunting
Dumanguena, Aborlan	N 09°26.811' E 118°25.264'	Ultrabasic	200- 580	Localised small-scale logging; *P. emphanum* trapping[1]

Eleven habitat and physical variables were recorded within a 20 m radius plot (10 m for some variables) around each census station (Appendix 1 lists the habitat variables recorded). This enabled us to compare the habitat around stations where we recorded the pheasant to those at which we did not record the species. Display scrape aggregates were located from the position of calling males recorded at count stations and along survey transects. DL and MW swept the area to locate all maintained scrapes and boundaries of the calling site. As with the census stations, habitat readings were taken within a 20 m radius plot surrounding each scrape site. The selection of habitat variables for measuring, counting or estimating at each plot largely follow McGowan *et al.* (1989) and McGowan (1994), who in turn considered the approach of Dueser & Shugart (1978) (Appendix 1 lists the habitat variables recorded). Differences between 'positive' (pheasant recorded) and 'negative' (pheasant not recorded) census stations, and between scrape sites and random points (non-scrape sites) were identified using multiple logistic regression.

RESULTS

Encounter rates

Palawan Peacock-pheasant was recorded in all forest types (primary forest, selectively logged and locally disturbed forest) and forest over all three soil types. Pheasant encounter rates differed both by soil type and method (Table 2): point count encounter rate on shale/sandstone > ultrabasic > limestone; line transect encounter rate on limestone > ultrabasic > shale/sandstone. Totals of 22 and 14 encounters with Palawan Peacock-pheasant were made at 438 point counts and 78.4 km of transects respectively. Across all sites and using both methods, 86.1% (n = 31) of pheasant encounters were of calling males, with sightings being very infrequent (see also McGowan *et al*. 1989) and all of females (n = 5). The pheasant was encountered within all altitudinal bands of 100 m at each of the five study sites, and ranged from sea level (SPSRNP) to 620 m (Trident). It was not recorded in non-forest areas, the limestone karst or coastal forests of SPSRNP, on ridge tops, or within 50 m of running water or 100 m of the edge of forest blocks.

Table 2: Survey effort and encounter rates of Palawan Peacock-pheasant stratified by method and soil type. Encounter rates are given as numbers of encounters per ten point counts, and number of encounters per km of transect.

Soil type	Point counts			Line transects		
	No. point counts	No. of encounters	Encounter rate	Survey effort (km)	No. of encounters	Encounter rate
Limestone (SPSRNP)	132	3	0.07	23.6	8	0.34
Shale/sandstone (Port Barton, Panaguman)	166	12	0.22	30.0	3	0.10
Ultrabasic (Trident, Dumanguena)	140	7	0.15	24.8	3	0.12
Total	438	22	0.15	78.4	14	0.18

Density estimates

Density estimates in forest on all three soil types and using both point count and line transect methods were very low (Table 3). Estimates derived from the point count data were higher for limestone, and shale/sandstone soil types than those from the line transects, but the highest estimate was just 1.2 individuals per km^2. While estimates from point counts and line transects were not dissimilar, the rank orders of abundances at sites were different between the two methods – Port Barton had the highest point count estimates but the lowest line transect estimate.

Table 3: Point count and line transect density estimates (individuals per km^2 ± percentage standard errors) and 95% confidence intervals for Palawan Peacock-pheasant in forest over different soil types. In both cases, estimates are based on a single detection function using data pooled across all three soil types. The point count data were best fitted by a negative exponential detection function model. The transect data were best fitted by a uniform function with cosine adjustment.

Site	Point counts		Line transects	
	D ± %SE	95% CI	D ± %SE	95% CI
SPSRNP (Limestone)	0.77 ± 59%	0.26 – 2.26	0.22 ± 48%	0.10 – 0.59
Port Barton, Panaguman (Shale/sandstone)	1.20 ± 50%	0.46 – 3.00	0.18 ± 56%	0.10 – 0.54
Narra, Dumanguena (Ultrabasic)	0.41 ± 68%	0.12 – 1.38	0.63 ± 38%	0.30 – 1.40

Habitat Associations

There were no consistent differences in habitat characteristics between points where the pheasant was recorded and where it was not (Table 4). Scrape sites, however, were associated with particular habitat features (Table 5). Logistic regression found scrapes to be strongly associated with areas containing high numbers of palms ($p < 0.001$), large trees ($p < 0.001$), and saplings ($p < 0.001$), sparse ground ($p < 0.001$) and shrub-layer vegetation ($p < 0.001$), more dense mid-storey vegetation ($p < 0.001$) and low numbers of fallen trees ($p < 0.05$).

Table 4: Means ± SD for habitat variables at points where the pheasant was recorded ('positive' census stations) and where it was not ('negative' census stations). Differences were tested using binary logistic regression. (Gbh = girth at breast height).

Variable	Present (n = 28)	Absent (n = 189)	F score, p
Gradient	23.2 ± 2.2	22.9 ± 0.8	$F = 0.03$, $p = 0.87$
Mean gbh of the two largest trees	224 ± 19.1	227 ± 7.8	$F = 0.18$, $p = 0.89$
Canopy percentage cover	32.5 ± 4.2	33.2 ± 1.4	$F = 0.36$, $p = 0.85$
Mid-storey percentage cover	52.1 ± 3.4	51.9 ± 1.2	$F = 0.01$, $p = 0.94$
Shrub layer percentage cover	41.1 ± 3.0	44.1 ± 1.3	$F = 0.70$, $p = 0.40$
Ground percentage cover	33.6 ± 5.3	33.9 ± 1.7	$F < 0.01$, $p = 0.95$
Number of palms	4.0 ± 1.0	5.7 ± 0.5	$F = 2.46$, $p = 0.12$
Number of fallen trees	0.8 ± 0.2	1.0 ± 0.1	$F = 0.92$, $p = 0.34$
Number of large trees (> 80 cm gbh)	11.0 ± 1.3	10.6 ± 0.4	$F = 0.11$, $p = 0.74$
Number of medium trees (20-80 cm gbh)	22.5 ± 1.4	22.5 ± 0.7	$F < 0.01$, $p = 1.00$
Number of saplings (< 20 cm gbh)	104 ± 8.0	94.0 ± 3.9	$F = 0.87$, $p = 0.35$

Table 5: Means ± SD for habitat variables at scrape sites and at census stations where no scrape sites were detected. Differences were tested using binary logistic regression.

Variable	Scrape present (n = 42)	Scrape absent (n = 217)	F score, p
Gradient	20.2 ± 1.2	22.9 ± 0.7	$F = 2.32$, $p = 0.128$
Mean gbh of the two largest trees	299 ± 35.1	226 ± 7.2	$F = 10.12$, $p = 0.001$
Canopy percentage cover	32.0 ± 2.2	33.1 ± 1.3	$F = 0.13$, $p = 0.717$
Mid-storey percentage cover	62.0 ± 2.2	51.9 ± 1.1	$F = 13.47$, $p < 0.001$
Shrub layer percentage cover	31.1 ± 1.8	43.7 ± 1.2	$F = 18.57$, $p < 0.001$
Ground percentage cover	18.7 ± 2.2	33.8 ± 1.6	$F = 14.98$, $p < 0.001$
Number of palms	13.2 ± 1.4	5.5 ± 0.4	$F = 38.79$, $p < 0.001$
Number of fallen trees	0.6 ± 0.2	0.9 ± 0.1	$F = 2.61$, $p = 0.107$
Number of large trees (> 80 cm gbh)	14.7 ± 0.5	10.7 ± 0.4	$F = 16.64$, $p < 0.001$
Number of medium trees (20-80 cm gbh)	22.6 ± 1.3	22.5 ± 0.6	$F = 0.01$, $p = 0.922$
Number of saplings (< 20 cm gbh)	141 ± 22.8	95.0 ± 3.6	$F = 12.12$, $p < 0.001$

DISCUSSION

Our research confirms the presence of *P. emphanum* at Port Barton, last recorded in 1988 (McGowan *et al*. 1989), and St Paul's, where it is often recorded by visiting birdwatchers and most recently published in 1994 (Hornbuckle 1994). Ours is the first record of the pheasant for the environs of Aborlan since 1962 (Collar *et al*. 1999), and new locations of the pheasant at Marofinas and in the surrounding hills of Narra. The Palawan Peacock-pheasant does seem to be widespread on mainland Palawan, although its dependence on forest habitats means that it is absent from unforested areas of the island.

Within forest habitats, the species does not appear to be highly specific in its distribution: our analysis failed to attribute its distribution to specific forest characteristics. Two factors make this analysis confusing. First, since encounter rates are low, sites of different soil type and histories are combined. This may have affected our ability to pin down habitat associations as these associations may have differed in the various study sites and habitats. Second, habitat and pheasant data were recorded over different scales of distance (around 20 m and 200 m respectively). The large radius required for pheasant contacts was necessary due to its rarity and the fact that most encounters pheasants were with calling males. It is very possible that the habitat is not homogenous enough over the two distances for the two data-sets to be compatible, particularly with respect to the broad habitat variables considered (e.g. percentage cover of vegetation layers).

In contrast, vegetation around scrape sites was distinctive and associated with high numbers of large trees, saplings, and palms, sparse ground and shrub-layer vegetation, dense mid-storey vegetation, and low numbers of fallen trees. These habitat features are characteristic of locally undisturbed, stable forest (Blake & Hoppes 1986). These results contrast with those of McGowan *et al* (1989) in that they found *P. emphanum* scrapes to be associated with areas of low density of large trees. However, we found the microhabitat surrounding Palawan Peacock-pheasant scrapes do match those of

Malaysian Peacock-pheasant *P. malacense* closely, whose scrapes were associated with large numbers of palms, and few tree falls (McGowan 1994). Again, however, McGowan (1994) found low densities of large trees at scrape sites, although this may be largely due to the smaller vegetation plot size surveyed (a radius of 5 m around scrape sites compared to our 20 m).

Our encounter rates, while certainly not high, were higher than those recorded by McGowan *et al* (1989), although direct comparison is inappropriate due to differences in survey methods, sites and seasons. Ours is one of the few attempts to use distance sampling to estimate pheasant densities and the problems encountered are worthy of investigation during future field seasons. We believe that our density estimates from both point count and line transect methods were unrealistically low. We suggest that the main reason for this is that pheasants were difficult to detect both visually and aurally. Failure to detect pheasants (usually visually) close to the transect line or census point is a serious violation of distance sampling assumptions (Buckland *et al.* 1993): only five pheasants were seen during censuses and none of these were males. Male calling was so infrequent during the fieldwork that most male pheasants went undetected during transect walks of point count periods simply because they did not call (this is despite a transect walking speed of just 1 km per hour, and an unusually long count period of 20 minutes per point). Focal studies of calling males at Narra yielded an average male calling rate of only 0.1 calling bouts per individual per hour (± 0.08 SD, n = 66 hours). With an individual male pheasant only likely to call around once per day at this time of the year (and an unknown proportion of the pheasant population not calling), then it is unsurprising that encounter rates and hence density estimates are so low. Equally clear is that encounter rates from point counts will tend to be higher than those from line transects because there is much longer sample period at a given position with then former that the latter (20 minutes at one point as opposed to an hour spent walking one kilometre). However, this certainly does not rule out distance sampling as a tool for tropical Galliform census as species may be surveyed reliably using a cue-counting distance sampling method with calls as cues (Buckland *et al.* 1993; Marsden 1998). We see this work on census methodology as being a priority for further investigation.

Further work on the pheasant and Palawan's other endemic birds is planned for the years 2001 and 2002. This research will include surveys of birds in areas as yet unstudied in order to build a better picture of the natural and anthropogenic factors that affect forest bird communities in different parts of the island. Focal work on the pheasant will include an assessment of the variability in male pheasant calling behaviour, and a study of the suitability of using cue-counting to census adult breeding males. We will also look more closely at the pheasant's ecological response to different habitat alterations and recommend land use management practices to ensure the survival of viable populations of this and other endemic bird species on Palawan in the face of increasing human pressures on the island's forest.

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APPENDIX 1: Habitat variables recorded at census stations and display scrapes.

* recorded within 10 m of focal point, ** recorded within 20 m of focal point

** Mean gradient
** Percentage covers of vegetation at canopy, mid-storey, shrub and ground levels
** Mean girth at breast height (gbh) of the two largest trees
** Number of fallen tree > 1.6 m gbh
** Number of trees of gbh > 0.8 m
* Number of trees of gbh ≥ 0.2 m but ≤ 0.8 m
* Number of saplings of gbh < 0.2 m
* Number of palms > 2 m tall